Claims

1. (Original) A method of detecting a chemical species with an oscillating cantilevered probe, comprising: driving a cantilevered beam into oscillation with a drive mechanism coupled to the cantilevered beam; tapping a free end of the oscillating cantilevered beam against a mechanical stop, the mechanical stop coupled to a base end of the cantilevered beam; measuring a first amplitude of the oscillating cantilevered beam with a sense mechanism coupled to the cantilevered beam; exposing a treated portion of the cantilevered beam to the chemical species, wherein the cantilevered beam bends when exposed to the chemical species; measuring a second amplitude of the oscillating cantilevered beam with the sense mechanism; and determining the chemical species based on the first amplitude and the second amplitude.

2. (Original) The method of claim 1 wherein the cantilevered beam comprises a material selected from the group consisting of silicon, polysilicon, silicon nitride, a metal film, a metal sheet, a zinc oxide film, a PZT film, a polymeric layer, and a combination thereof.

3. (Original) The method of claim 1 wherein the drive mechanism is selected from the group consisting of a piezoelectric drive, an electrostatic drive, a thermal drive, and a magnetic drive.

4. (Original) The method of claim 1 wherein measuring the amplitude of the oscillating cantilevered beam comprises: directing a beam of light onto a surface of the oscillating

cantilevered beam; and detecting the beam of light when the beam of light is reflected from the surface of the oscillating cantilevered beam.

5. (Canceled)

6. (Original) The method of claim 1 wherein the sense mechanism is selected from the group consisting of an optical sense mechanism, a piezoelectric sense mechanism, a piezoresistive sense mechanism, a capacitive sense mechanism, and a magnetic sense mechanism.

7. (Original) The method of claim 1 wherein the treated portion of the cantilevered beam comprises a coating selected from the group consisting of a gold layer, a palladium layer, an alcohol-absorbent polymer, a water-absorbent material, a chemical-sensitive layer, a biosensitive material, and a thiol.

8. (Original) The method of claim 1 wherein the chemical species is selected from the group consisting of mercury, hydrogen, an alcohol, water vapor, a chemical element, a chemical compound, an organic material, an inorganic material, a biological material, a DNA strand, a bioactive agent, and a toxin.

9. (Original) The method of claim 1 further comprising: adjusting a position of the mechanical stop with a positioning element coupled to the mechanical stop to maintain

the oscillating cantilevered beam at a nominally constant amplitude; and determining the chemical species based on the position of the mechanical stop.

10. (Original) The method of claim 1 further comprising: measuring a frequency of the oscillating cantilevered beam with the sense mechanism coupled to the cantilevered beam; and determining the chemical species based on the measured frequency.

11. (Original) The method of claim 1 further comprising: heating a heater coupled to the cantilevered beam to initialize the treated portion of the cantilevered beam.

12. (Original) A system for sensing a chemical species, comprising: a cantilevered beam including a treated portion; a drive mechanism coupled to the cantilevered beam; a sense mechanism coupled to the cantilevered beam; and a mechanical stop coupled to a base end of the cantilevered beam; wherein the cantilevered beam is driven into oscillation and tapped against the mechanical stop by the drive mechanism, and the chemical species is determined based on an oscillation amplitude measured by the sense mechanism when the treated portion of the cantilevered beam is exposed to the chemical species.

13. (Original) The system of claim 12 wherein the cantilevered beam comprises a layer selected from the group consisting of silicon, polysilicon, silicon nitride, a metal film, a metal sheet, a zinc oxide film, a PZT film, a piezoelectric film, a piezoresistive film, a dielectric film, a polymeric layer, and a combination thereof.

14. (Original) The system of claim 12 wherein the drive mechanism is selected from the group consisting of a piezoelectric drive, an electrostatic drive, a thermal drive, and a magnetic drive.

15. (Original) The system of claim 12 wherein the sense mechanism is selected from the group consisting of a piezoelectric sense mechanism, an optical sense mechanism, a piezoresistive sense mechanism, a capacitive sense mechanism, and a magnetic sense mechanism.

16. (Original) The system of claim 12 wherein the drive mechanism and the sense mechanism comprise a unitary piezoelectric element coupled to the cantilevered beam.

17. (Original) The system of claim 12 wherein the treated portion of the cantilevered beam comprises a coating selected from the group consisting of a gold layer, a palladium layer, an alcohol-absorbent polymer, a water-absorbent material, a chemical-sensitive layer, a biosensitive material, and a thiol.

18. (Original) The system of claim 12 wherein the chemical species is selected from the group consisting of mercury, hydrogen, an alcohol, water vapor, a chemical element, a chemical compound, an organic material, an inorganic material, a biological material, a DNA strand, a bioactive agent, and a toxin.

19. (Original) The system of claim 12 further comprising: a light source for directing a beam of light onto the cantilevered beam; and a photodetector for detecting the beam of light reflected from the cantilevered beam, wherein the oscillation amplitude is measured by the photodetector.

20. (Original) The system of claim 12 further comprising: a probe tip attached to the free end of the oscillating cantilevered beam, wherein the probe tip is tapped against the mechanical stop when the cantilevered beam is oscillated.

21. (Original) The system of claim 12 further comprising: a positioning element coupled between the mechanical stop and the base end of the cantilevered beam, wherein the positioning element adjusts a position of the mechanical stop to maintain an oscillation of the cantilevered beam at a nominally constant amplitude.

22. (Original) The system of claim 21 wherein the positioning element comprises a piezotube.

23. (Original) The system of claim 12 further comprising: an enclosure enclosing the cantilevered beam and the mechanical stop, the enclosure having an inlet port for the ingression of the chemical species and an outlet port for the egression of the chemical species.

24. (Original) The system of claim 12 further comprising: means for measuring a frequency of the oscillating cantilevered beam; and means for determining the chemical species based on the measured frequency.

25. (Original) The system of claim 12 further comprising: a heater coupled to the cantilevered beam, wherein the treated portion of the cantilevered beam is initialized when the cantilevered beam is heated.

26. (Original) A handheld system for sensing a chemical species comprising: at least one cantilevered beam, wherein at least one cantilevered beam includes a treated portion; a mechanical stop coupled to a base end of each cantilevered beam; and a piezoelectric drive-sense mechanism coupled to each cantilevered beam; wherein the chemical species is sensed based on an oscillation amplitude of each of the at least one cantilevered beams when the treated portion of at least one cantilevered beam is exposed to the chemical species.

27. (Original) The system of claim 26 further comprising: a positioning element coupled between the base end of at least one cantilevered beam and the mechanical stop, wherein the positioning element adjusts a position of the mechanical stop to maintain an oscillation of the at least one cantilevered beam at a nominally constant amplitude.